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Yen et al.

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(54) **ELECTRICAL CONNECTOR**

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H01R 13/506 (2006.01)
H01R 13/6594 (2011.01)
H01R 107/00 (2006.01)

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CPC **H01R 24/60** (2013.01); **H01R 13/6585**

(2013.01); **H01R 13/506** (2013.01); **H01R 13/6594** (2013.01); **H01R 2107/00** (2013.01)

(58) **Field of Classification Search**

CPC **H01R 13/6587**; **H01R 13/6594**; **H01R 23/6873**; **H01R 23/7073**
USPC **439/607.4**, **607.35**, **607.11**, **660**
See application file for complete search history.

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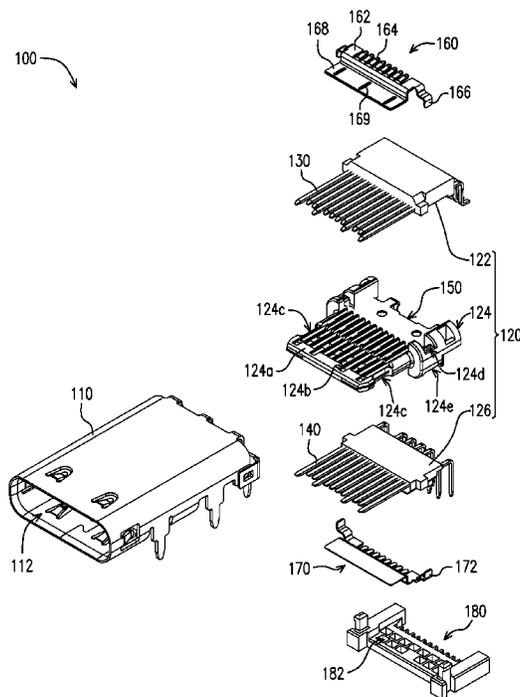
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(57) **ABSTRACT**

An electrical connector comprises an external conductive sheet, an upper internal conductive sheet, a lower internal conductive sheet and the necessary others. An insulative base is disposed within a casing and includes a top complex, a center complex, and a bottom complex in sequential connection. The upper internal conductive sheet and the lower internal conductive sheet are fixed to the insulative base. Thereafter, an improving electrical connector interface is provided.

9 Claims, 8 Drawing Sheets



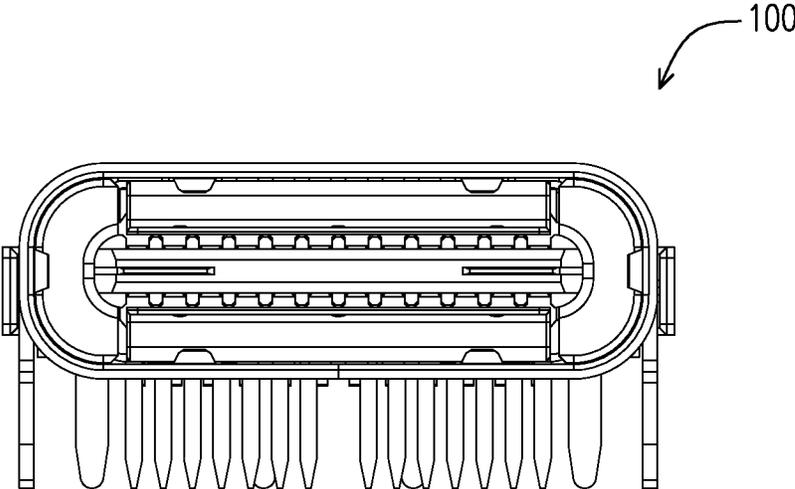


FIG. 1

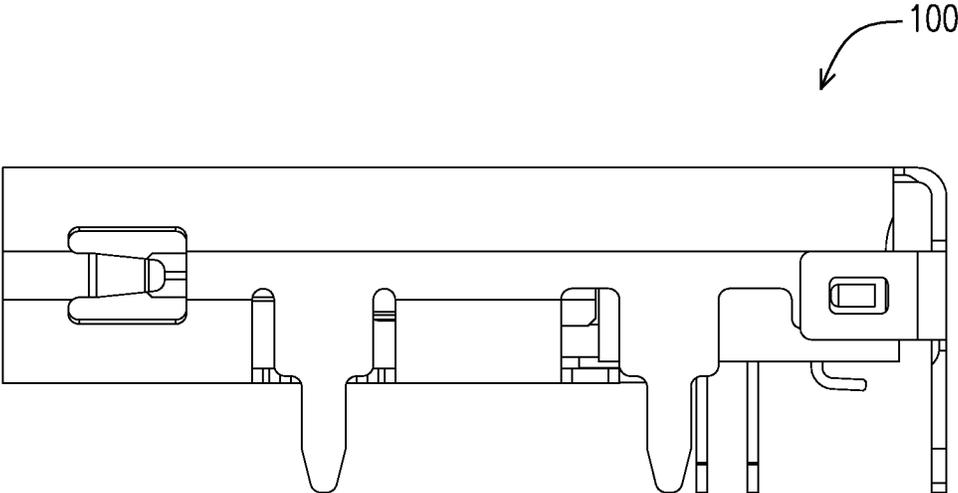


FIG. 2

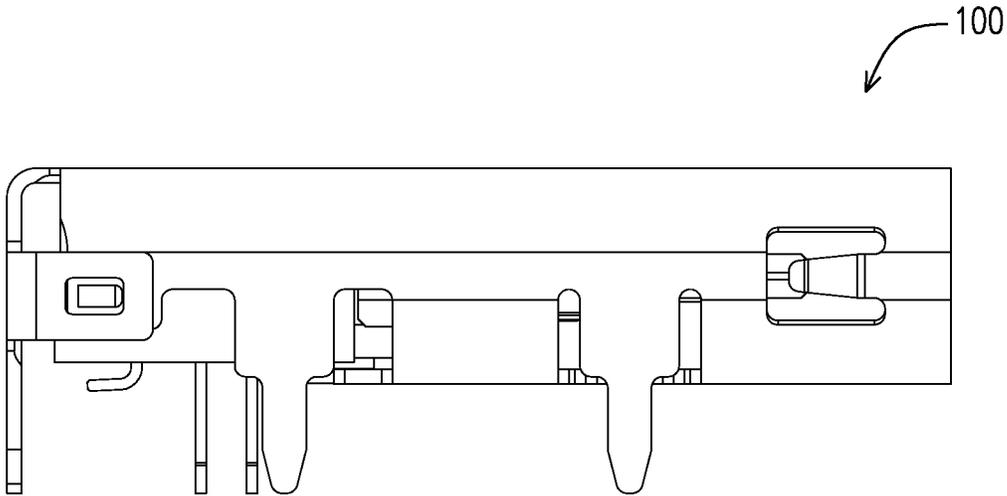


FIG. 3

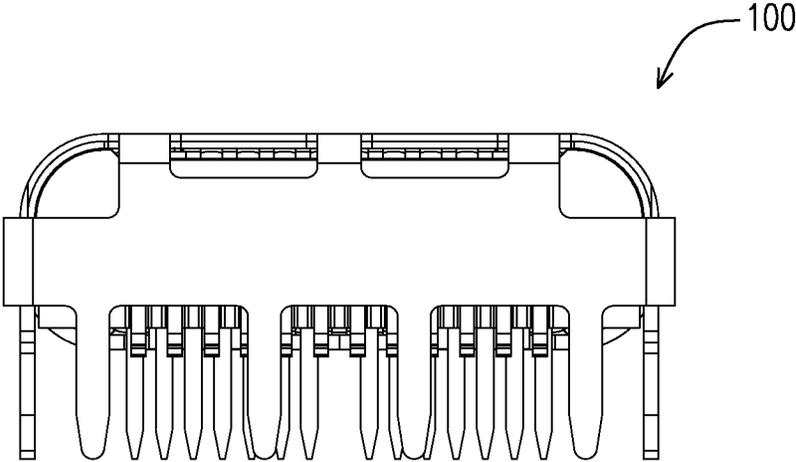


FIG. 4

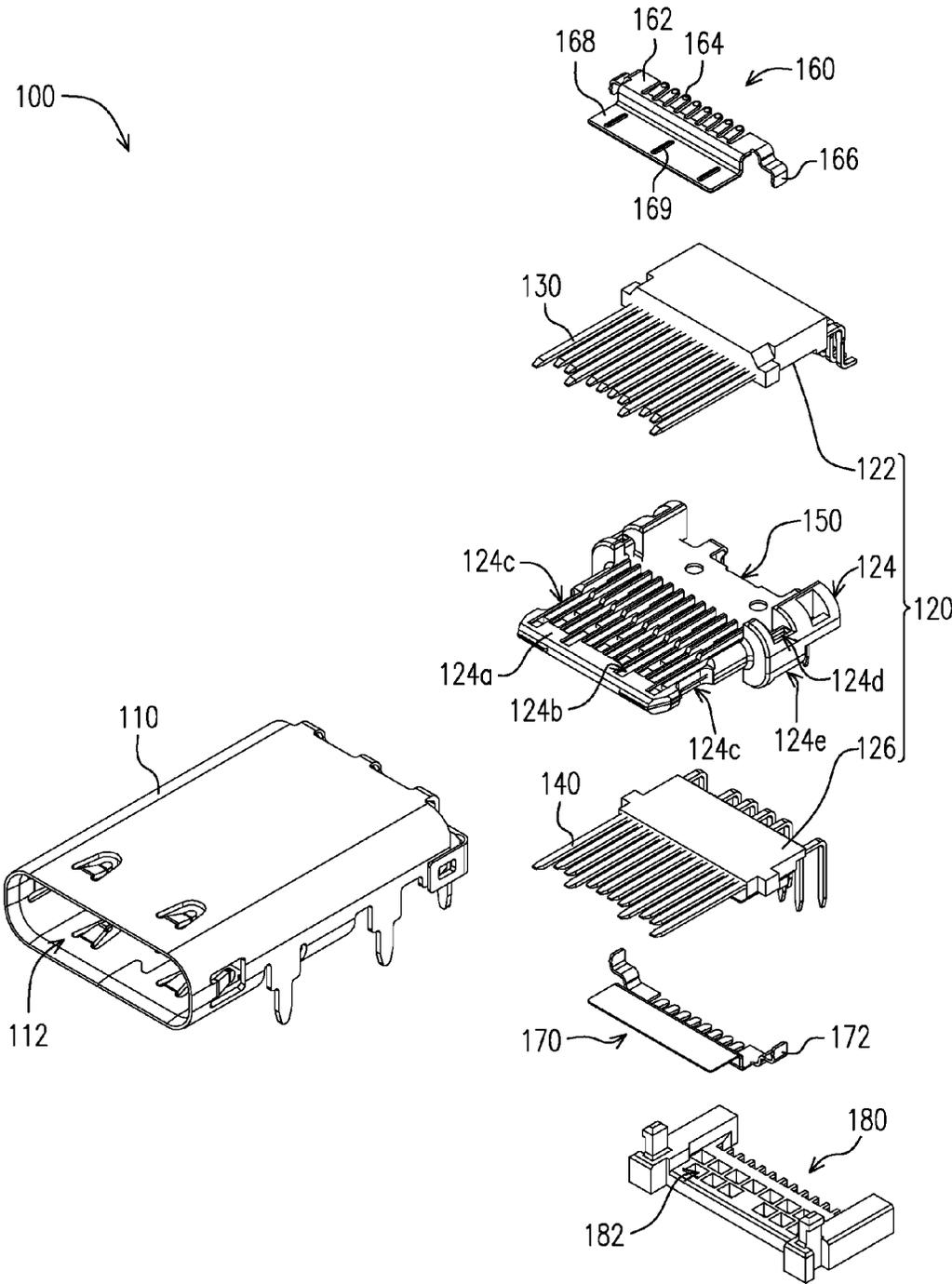


FIG.5

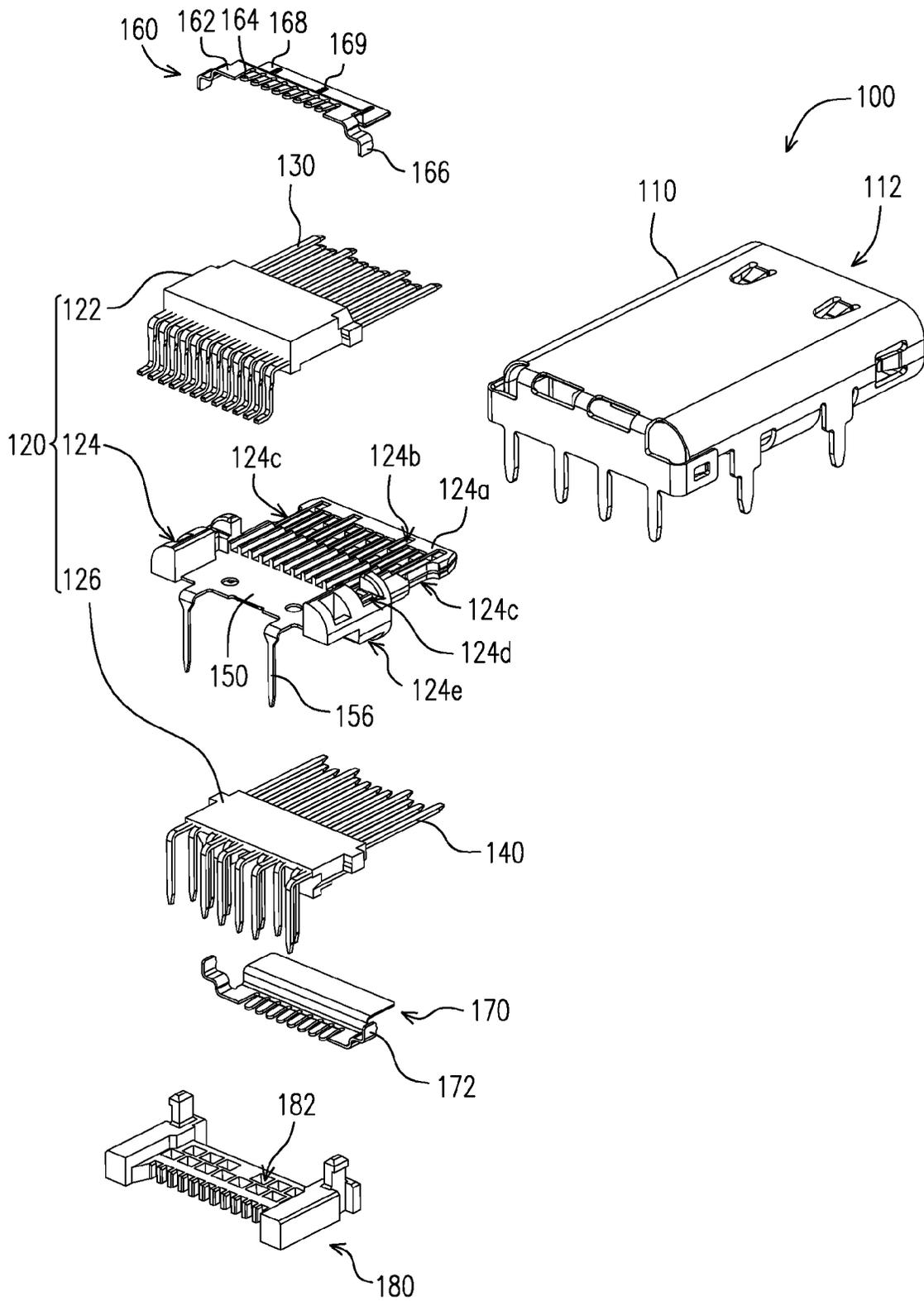


FIG. 6

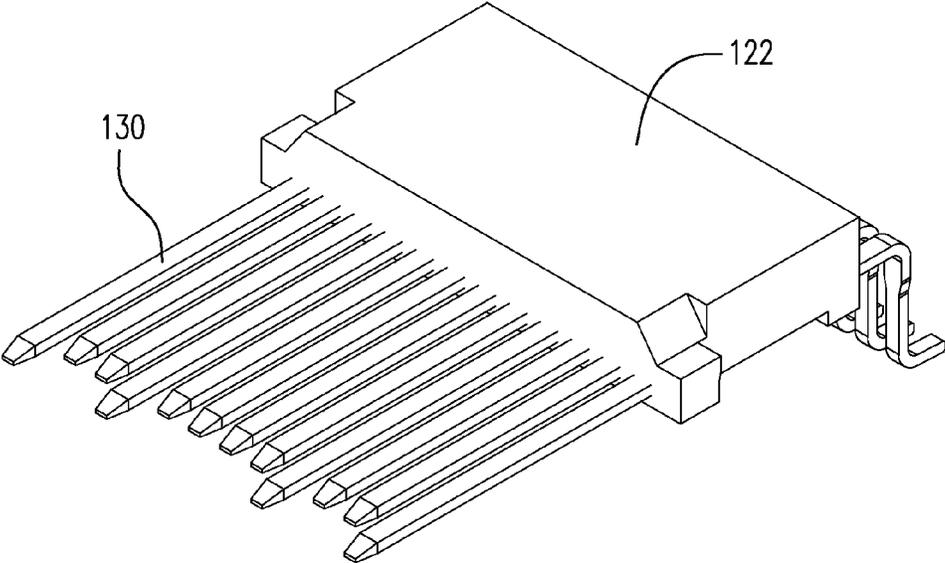


FIG. 7

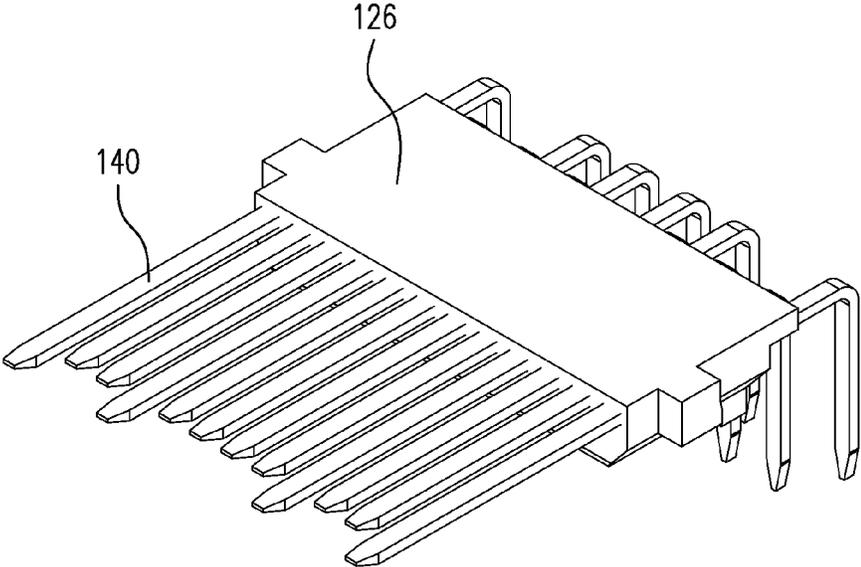


FIG. 8

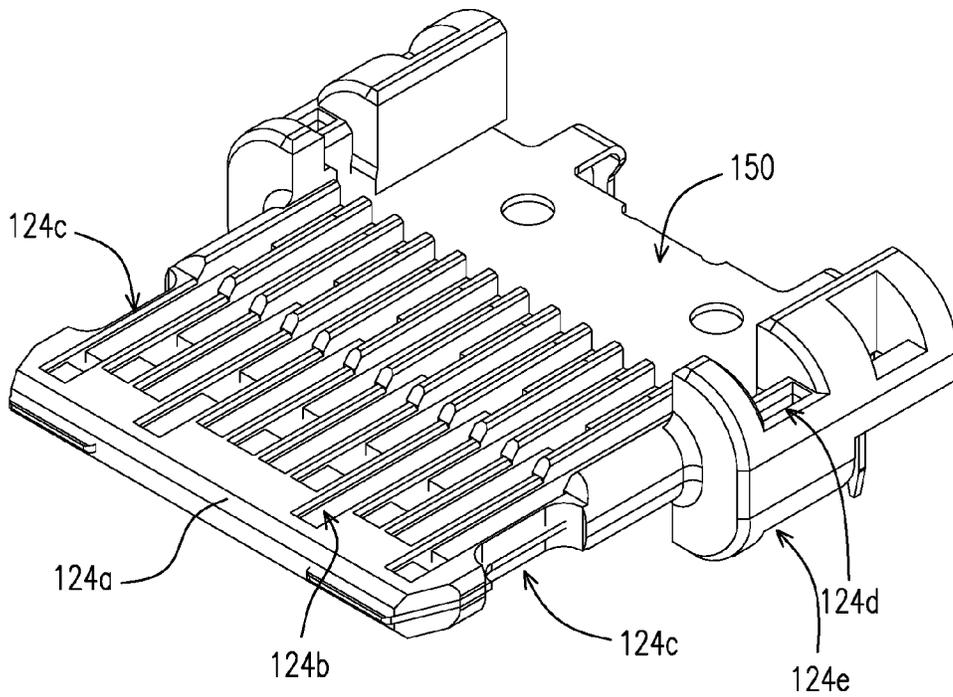


FIG. 9

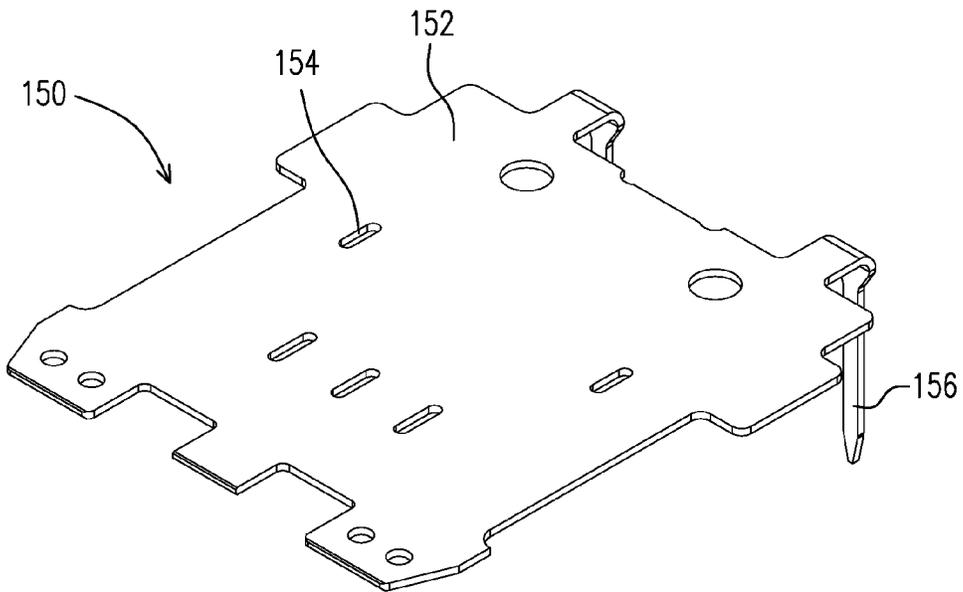


FIG. 10

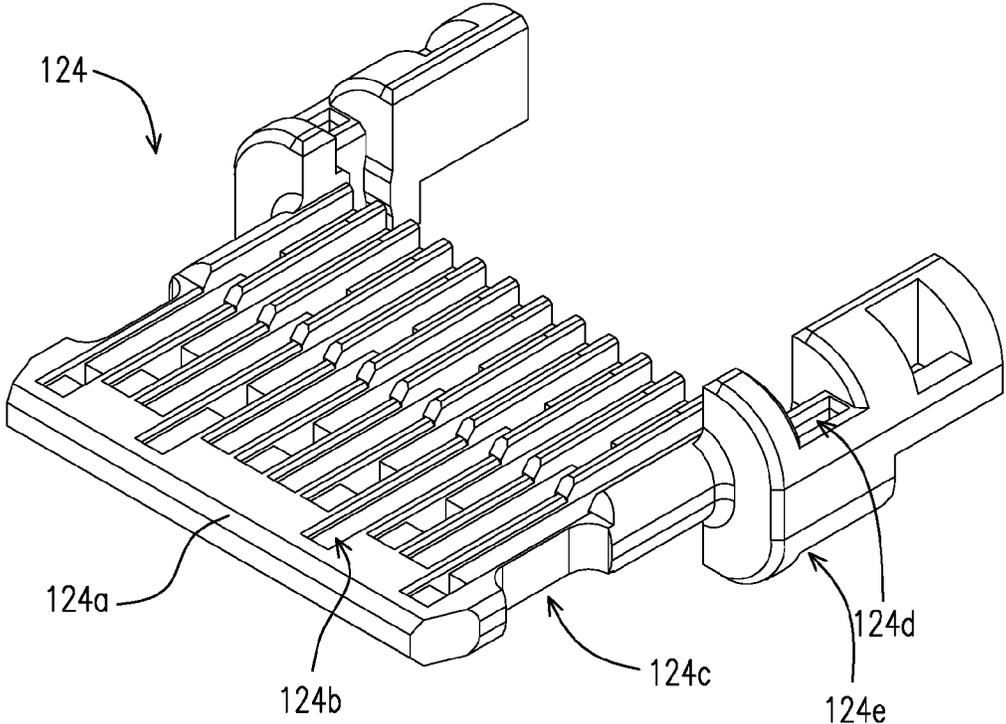


FIG. 11

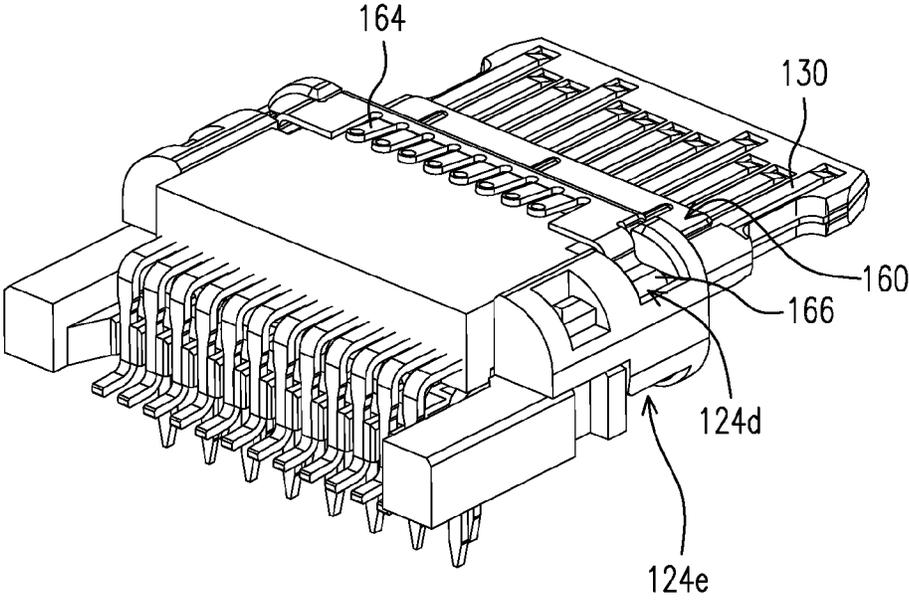


FIG. 12

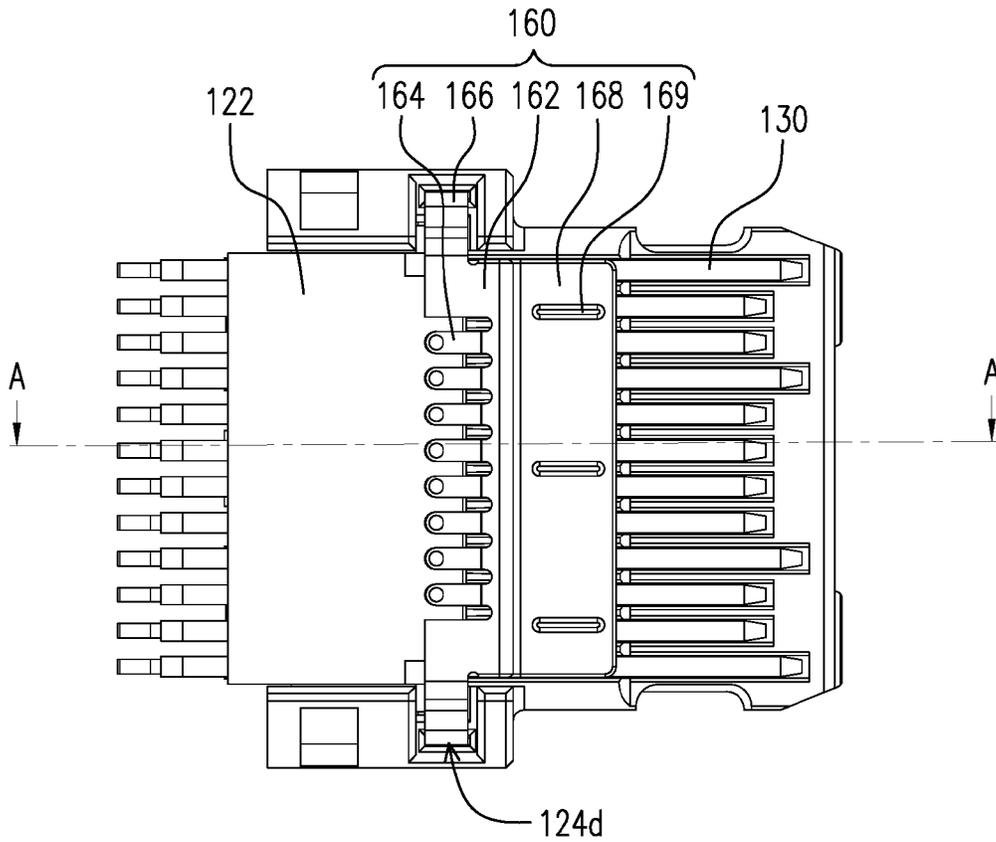


FIG. 13

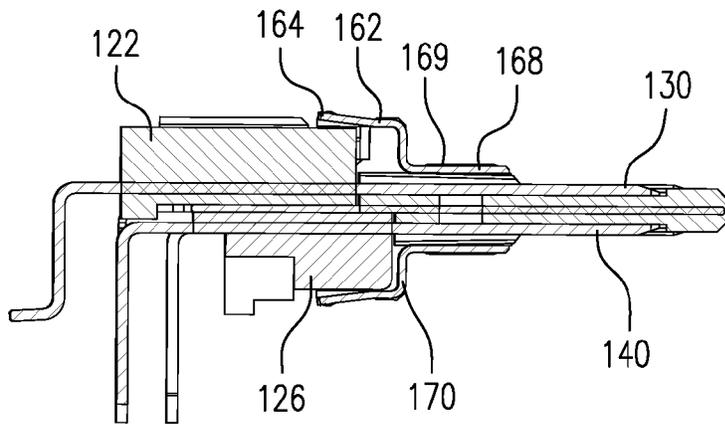


FIG. 14

ELECTRICAL CONNECTOR**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of the filing date under 35 U.S.C. §119(a)-(d) of Taiwan Patent Application No. 103214719, filed Aug. 18, 2014.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

The present invention relates to an electrical connector.

2. Description of the Related Art

As technology advances, the sizes of electrical connectors are getting smaller and smaller, and the number of terminals increases with the upgrade of the transmission specifications. Take one of the new electrical connector specifications (USB C type connector) as an example: the overall size of a USB C type electrical connector is smaller than the USB 2.0 electrical connector, and the USB C type electrical connector has two rows of terminals, in which the number of terminals in each row is 12.

In other words, a USB C type connector includes a larger amount of terminals needed to be disposed in a smaller space (the insulative base) as compared with the USB 2.0 electrical connector. In consideration of holes provided as corresponding to the positions of the terminals in the insulative base of an electrical connector, therefore, if the number of terminals increases, the structural strength of the insulative base will reduce. Furthermore, since the terminals are narrowed in width, the structural strength of the terminals becomes weaker. When this kind of electrical connector is being assembled, the differences among the strengths exerted on the terminals by different operators may lead to a bend or a curve in the terminals and a false installation of the terminals on the insulative base. In addition, since the terminal width is very small and the number of terminals is quite large, the operators have difficulties determining with eyes whether the terminals are properly assembled. Therefore, such kind of electrical connector has higher defect rate.

SUMMARY OF THE INVENTION

The present invention provides an electrical connector with novel structure and preferred assembly yield.

The electrical connector of the present invention comprises: a casing, an insulative base, a plurality of first terminals, a plurality of second terminals, an external conductive sheet, an upper internal conductive sheet, and a lower internal conductive sheet. The insulative base is disposed within the casing and includes a top complex, a center complex, and a bottom complex in sequential connection. The plurality of first terminals and the plurality of second terminals penetrate through the top complex and the bottom complex respectively. The external conductive sheet penetrates through the center complex to isolate plurality of first terminals and the plurality of second terminals. The upper internal conductive sheet is fixed to the insulative base and disposed at a side of the top complex in such a manner that a partial portion of the plurality of first terminals is sheltered by the upper internal conductive sheet. The lower internal conductive sheet is fixed to the insulative base and disposed at a side of the bottom complex in such a manner that a partial portion of some of the plurality of second terminals is sheltered by the lower internal conductive sheet.

According to one embodiment of the present invention, the insulative base includes at least one first engagement hole and at least one second engagement hole. The upper internal conductive sheet includes at least one first positioning protrude which is inserted into the first engagement hole. The lower internal conductive sheet includes at least one second positioning protrude which is inserted into the second engagement hole.

According to one embodiment of the present invention, the first engagement hole and the second engagement hole are disposed within the center complex.

According to one embodiment of the present invention, the center complex includes a tongue, whose two opposite surfaces have a plurality of ditches for accommodating a partial portion of some of the plurality of some of first terminals and a partial portion of the plurality of second terminals.

According to one embodiment of the present invention, the internal conductive sheet includes a first section and a second section connected to the first section. There is a turn between the first section and the second section. The first section covers a partial portion of the top complex, and the second portion covers a partial portion of some of the plurality of first terminals.

According to one embodiment of the present invention, the first section of the internal conductive sheet includes a plurality of arms, which slightly tilts toward the casing.

According to one embodiment of the present invention, the second section of the internal conductive sheet includes a plurality of resistant contacts, which are used to contact a corresponding electrical connector to increase the plug strength between the two.

According to one embodiment of the present invention, the external conductive sheet includes an ECS body and a plurality of apertures penetrating the ECS body, wherein a partial portion of the center complex extends into the apertures.

According to one embodiment of the present invention, the external conductive sheet includes at least one conductive tail perpendicular to the ECS body. At least one conductive tail and a partial portion of the second terminals that is disposed at a position far away from an opening of the casing are arranged in the same column.

According to one embodiment of the present invention, a partial portion of the external conductive sheet is exposed to the leading edge and side edge of the center complex.

According to one embodiment of the present invention, the electrical connector of the present invention further includes a block including a plurality of notches which are arranged in at least two rows, and the portion of the second terminals that are disposed at a position far away from the opening of the casing penetrates through at least one partial portion of the notches.

According to the above-mentioned structures, the electrical connector of the present invention provides the external conductive sheet between the first terminals and the second terminals to prevent the signal which is sent from the first terminals and the signal which is sent from the second terminals from being interfered with one another. Moreover, the present invention is which disposes the top complex and the bottom complex with the upper internal conductive sheet and the lower internal conductive sheet respectively, and disposes the casing to cover the above-mentioned components to provide the electrical connector with better anti-electromagnetic interference effects. Besides, the assembly of the electrical connector of the present invention begins with inserting the first terminals, the external conductive sheet, and the second terminals into the top complex, the center complex, and the bottom complex respectively via a production method such as

Insert-Molding process, and thereafter performs a step of assembling the top complex, the center complex, and the bottom complex together. Next, the conductive tail and the partial portion of the second terminals that is disposed at a position far away from the opening of the casing are covered with the block, and finally the first positioning protrude of the upper internal conductive sheet and the second positioning protrude of lower internal conductive sheet are inserted into the first engagement hole and the second engagement hole of the center complex in such a manner that after the upper internal conductive sheet and the lower internal conductive sheet are disposed at a side of the top complex and the center complex, the upper internal conductive sheet and the lower internal conductive sheet together with the top complex and the center complex are inserted into the casing. The configuration structure of the present invention and the above-mentioned assembly methods can effectively enhance the overall assembly yield.

The present invention is further explained by the preferred embodiments and the appended drawings below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of an electrical connector according to one embodiment of the present invention.

FIG. 2 to FIG. 4 are schematic diagrams of the electrical connector shown in FIG. 1 viewed from different angles.

FIG. 5 is an exploded perspective view of the electrical connector shown in FIG. 1.

FIG. 6 is a schematic diagram of the electrical connector shown in FIG. 5 viewed from different angles.

FIG. 7 is a schematic diagram of a top complex and a plurality of first terminals of the electrical connector shown in FIG. 1.

FIG. 8 is a schematic diagram of a bottom complex and a plurality of second terminals of the electrical connector shown in FIG. 1.

FIG. 9 is a schematic diagram of a center complex and an external conductive sheet of the electrical connector shown in FIG. 1.

FIG. 10 is a schematic diagram of the external conductive sheet of the electrical connector shown in FIG. 1.

FIG. 11 is a schematic diagram of the center complex of the electrical connector shown in FIG. 1.

FIG. 12 is a three dimensional view of the electrical connector without the casing.

FIG. 13 is a schematic diagram of the electrical connector shown in FIG. 12 viewed from another angle.

FIG. 14 is a sectional schematic view along line A-A shown in FIG. 13.

DETAILED DESCRIPTION OF THE EMBODIMENT(S)

FIG. 1 is a schematic diagram of an electrical connector 100 according to one embodiment of the present invention. FIG. 2 to FIG. 4 are schematic diagrams of the electrical connector 100 shown in FIG. 1 viewed from different angles. More specifically, FIG. 1 is a front view of the electrical connector 100 according to this embodiment, and FIG. 2, FIG. 3 are respectively the left side view and the right side view of the electrical connector 100 according to this embodiment. FIG. 4 is a back side view of the electrical connector 100 according to this embodiment. In this embodiment, the electrical connector 100 is a female USB C type connector, but the present invention does not limit the type of the electrical connector 100.

The detailed components of the electrical connector 100 according to this embodiment are shown in FIG. 5 and FIG. 6. FIG. 5 is an exploded perspective view of the electrical connector 100 shown in FIG. 1. FIG. 6 is a schematic diagram of the electrical connector 100 shown in FIG. 5 viewed from different angles. The electrical connector 100 of this embodiment comprises: a casing 110, an insulative base 120 disposed within the casing 110, a plurality of first terminals 130, a plurality of second terminals 140, an external conductive sheet 150, an upper internal conductive sheet 160, a lower internal conductive sheet 170, and a block 180.

FIG. 7 is a schematic diagram illustrating a top complex 122 and a plurality of first terminals 130 of the electrical connector 100 shown in FIG. 1. FIG. 8 is a schematic diagram illustrating a bottom complex 126 and a plurality of second terminals 140 of the electrical connector 100 shown in FIG. 1. FIG. 10 is a schematic diagram illustrating the external conductive sheet 150 of the electrical connector 100 shown in FIG. 1. FIG. 11 is a schematic diagram illustrating a center complex 124 of the electrical connector 100 shown in FIG. 1. FIG. 9 is a schematic diagram illustrating a center complex 124 and the external conductive sheet 150 of the electrical connector 100 shown in FIG. 1. Please refer to FIG. 5 to 11, wherein the insulative base 120 includes the top complex 122, the center complex 124, and the bottom complex 126 in sequential connection. In this embodiment, the center complex 124 and the bottom complex 126 are made of insulating materials, such as resins or high-polymer. However, the materials of the center complex 124 and the bottom complex 126 are not limited to these as long as they possess insulating properties.

A partial portion of these plurality of first terminals 130 and a partial portion of these plurality of second terminals 140 penetrate through the top complex 122 and the bottom complex 126 respectively. More specifically, the middle portion of the first terminals 130 and the middle portion of the second terminals 140 penetrate through the top complex 122 and the bottom complex 126, and the opposite ends of the first terminals 130 and the opposite ends of the second terminals 140 are exposed outside the top complex 122 and the bottom complex 126. An end of the first terminals 130 and an end of the second terminals 140 that are disposed at a position near an opening 112 of the casing 110 are for connecting a corresponding electrical connector (not shown in the drawings). An end of the first terminals 130 and an end of second terminals 140 that are disposed at a position far away from the opening 112 of the casing 110 are for connecting with a circuit board (not shown in the drawings). The external conductive sheet 150 penetrates through the center complex 124 to isolate the first terminals 130 and the second terminals 140 so as to prevent the signal which is sent from the first terminals 130 and the signal which is sent from the second terminals 140 from interfering with each other.

In this embodiment, the assembly of the electrical connector begins with disposing the first terminals 130, the external conductive sheet 150, and the second terminals 140 within the top complex 122, the center complex 124, and the bottom complex 126 respectively via Insert-Molding process, followed by fixing relative positions among the top complex 122, the center complex 124, and the bottom complex 126. However, the method of assembling the first terminals 130, the external conductive sheet 150, the second terminals 140, the top complex 122, the center complex 124, and the bottom complex 126 is not limited to this. In other embodiments, the first terminals 130, the external conductive sheet 150, and the second terminals 140 can be fixed to the top complex 122, the center complex 124, and the bottom complex 126 by being

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inserted into the top complex 122, the center complex 124, and the bottom complex 126. Moreover, the relative positions among the top complex 122, the center complex 124, and the bottom complex 126 can be fixed by integrally-molded process or by other methods such as sticking the complexes together.

In this embodiment, the electrical connector 100 is a female USB C type connector. The number of the first terminals 130 and the number of the second terminals 140 are both 12. The center complex 124 includes a tongue 124a, whose two opposite surfaces have a plurality of ditches 124b. In this embodiment, each of the two opposite surfaces of the tongue 124a has twelve ditches 124b, and it is noted although FIG. 5, FIG. 6, FIG. 9, and FIG. 11 only show the upper surface of the tongue 124a having ditches 124b due to the limited viewing angle, the lower surface of the tongue 124a also has ditches 124b. A portion of the twelve first terminals 130 and a portion of the twelve second terminals 140 that are in a position near the opening 112 of the casing 110 are disposed to insert into the ditches 124b of the upper and lower surface of the tongue 124a to fix the relative position between the plurality of the first terminals 130 and the plurality of the second terminals 140.

Seen from the viewing angle of FIG. 6, the partial portions of the twelve first terminals 130 that are disposed at a position far away from the opening 112 of the casing 110 are arranged in the same row, and the partial portions of the twelve second terminals 140 that are disposed at a position far away from the opening 112 of the casing 110 are arranged in two rows, in which each row has six second terminals 140. Certainly, in other embodiments, the number of the first terminals 130, the number of the second terminals 140, and the arrangement method of the partial portions of the first terminals 130 and the second terminals 140 that are disposed at a position far away from the opening 112 of the casing 110 are not limited to the above-mentioned description. In other embodiments of different kinds of electrical connector 100 (not shown in the drawings), the electrical connectors 100 can be arranged with only the first terminals 130, in which the partial portions of the first terminals 130 that are disposed at a position far away from the opening 112 of the casing 110 are disposed in different rows. Alternatively, the electrical connectors 100 can include both the first terminals 130 and the second terminals, wherein the partial portions of the second terminals 140 that are disposed at a position far away from the opening 112 of the casing 110 can be arranged in the same row.

Besides, in this embodiment, the external conductive sheet 150 includes an ECS body 152 and a plurality of apertures 154 penetrating the ECS body 152 so as to stably insert and fix the external conductive sheet 150 into the center complex 124, as shown in FIG. 10. In the insert-molding process, a partial portion of the center complex 124 reaches into the apertures 154 to increase the adhesion between the apertures 154 and the center complex 124.

Furthermore, the external conductive sheet 150 includes at least one conductive tail 156 perpendicular to the ECS body 152. In this embodiment, the external conductive sheet 150 includes two conductive tails 156. As can be seen in FIG. 6 and FIG. 8, the partial portions of the second terminals 140 that are disposed at a position far away from an opening 112 of the casing 110 are arranged in two rows. The row near the outside has six second terminals 140, in which the distance between the any one of the outermost second terminals 140 and it neighboring second terminals 140 is twice longer than the distance between the middle two second terminals 140. In this row, the space between any one of the outermost second terminals 140 and its neighboring second outermost second

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terminals 140 is for accommodating the two conductive tails 156 of the external conductive sheet 150 in such a manner that the two conductive tails and the six second terminals are in the same row. Obviously, in other embodiment, the conductive tails 156 and the six second terminals 140 can be arranged in different rows.

Besides, as can be seen in FIG. 9, a partial portion of the external conductive sheet 150 is exposed at the leading edge and side edge of the center complex 124. In detail, each outer side of the center complex 124 has a recession 124c, in which a partial portion of the external conductive sheet 150 is exposed at the recession 124c. Moreover, partial portions of the external conductive sheet 150 are exposed at the two outer sides of the leading edge of the center complex 124. When the electrical connector 100 of this embodiment connects with a corresponding electrical connector, the two partial portions of the external conductive sheet 150 that are exposed at the two recessions 124c of the two outer edge of the center complex 124 and the two partial portions of the external conductive sheet 150 that are exposed at the two sides of the leading edge of the center complex 124 can electrically connect with the corresponding electrical connector. In this embodiment, the external conductive sheet 150 is not exposed outside the whole leading edge of the center complex 124 so as to maintain the structural strength of the center complex 124. However, in other embodiments, if other ways exist for increasing the structural strength of the center complex 124, the external conductive sheet 150 can be exposed outside the leading edge of the center complex 124. Certainly, the partial portion of the center complex 124 at which the external conductive sheet 150 is exposed is not limited to this.

Please refer back to FIG. 5 and FIG. 6. The block 180 includes a plurality of notches 182 to fix the relative positions among the partial portions of the second terminals 140 that are disposed at a position far away from the opening 112 of the casing 110. Since the portions of the second terminals 140 disposed at a position far away from the opening 112 of the casing 110 are arranged in two rows, the plurality of notches 182 of the block 180 corresponding to the two rows of the second terminals 140 are arranged in two rows in such manner that the second terminals 140 penetrate through a place far away from the opening 112 of the casing 110. Certainly, in other embodiments, the number of rows of the notches 182 can vary according to the arrangement method of the second terminals 140, or the arrangement method of the first terminals 130.

FIG. 12 is a three dimensional view of the electrical connector 100 of FIG. 1 without the casing 110. FIG. 13 is a schematic diagram of the electrical connector 100 shown in FIG. 12 viewed from another angle. FIG. 14 is a sectional schematic view along line A-A shown in FIG. 13. FIG. 12 to FIG. 14 are schematic diagrams of assembling the elements of the electrical connector 100 of this embodiment without the casing 110. Please refer to FIG. 5, FIG. 12 to FIG. 14 at the same time. The upper internal conductive sheet 160 is disposed at a side of the top complex 120, sheltering a partial portion of some of the plurality of first terminals 130. The lower internal conductive sheet 170 is disposed at a side of the bottom complex 126, sheltering a partial portion of some of the plurality of second terminals 140. In addition to the casing 110 made of metal material that provides anti-electromagnetic effect, the electrical connector 100 of this embodiment achieves anti-electromagnetic interference effect also through the setting of the upper internal conductive sheet 160 and the lower internal conductive sheet 170 so as to enhance the anti-electromagnetic interference effect.

The upper internal conductive sheet **160** and the lower internal conductive sheet **170** are fixed to the insulative base **120** by assembly methods. In detail, the center complex **124** of the insulative base **120** includes at least one first engagement hole **124d** and at least one second engagement hole **124e**. The upper internal conductive sheet **160** and the lower internal conductive sheet **170** respectively include at least one first positioning protrude **166** and at least one second positioning protrude **172**. The first positioning protrude **166** and the second positioning protrude **172** are inserted into the first engagement hole **124d** and the second engagement hole **124e** respectively in such a manner that the upper internal conductive sheet **160** and the lower internal conductive sheet **170** are fixed to the insulative base **120**. Certainly, in other embodiments, the first engagement hole **124d** and the second engagement hole **124e** can be disposed at in the top complex **122** or the bottom complex **126**.

In addition, as shown in FIG. 5, FIG. 13 and FIG. 14, the internal conductive sheet **160** includes a first section **162** and a second section **168** connected to the first section **162**. There exists a turn between the first section **162** and the second section **168**. The first section **162** covers a partial portion of the top complex **122**, and the second portion **168** covers a partial portion of the plurality of first terminals **130**. The first section **162** of the internal conductive sheet **160** includes a plurality of arms **164**, which slightly tilts toward the casing **110** (shown in the top of FIG. 14). When the casing **110** is mounted onto the above-mentioned components, the plurality of arms **164** of the internal conductive sheet **160** are electrically connected with the casing **110**. The second section **168** of the internal conductive sheet **160** includes a plurality of resistant contacts **169**. When a corresponding electrical connector connects with the electrical connector **100** of this embodiment, the corresponding electrical connector contacts the resistant contacts **169** to increase the resistance between the electrical connector and the corresponding electrical connector.

In this embodiment, it is noted that the lower internal conductive sheet **170** includes a plurality of arms and a plurality of resistant contacts as well, which is not shown in the schematic diagrams due to the viewing angle. The shape and function of the arms and the resistant contacts of the lower internal conductive sheet **170** are similar to that of the arms **164** and the resistant contacts **164** of the internal conductive sheet **160**, and therefore the details about the arms and the resistant contacts of the lower internal conductive sheet **170** will not be presented here.

In summary, the electrical connector **100** of the present invention provides the external conductive sheet **150** between the first terminals **130** and the second terminals **140** to prevent the signal which is sent from the first terminals **130** and the signal which is sent from the second terminals **140** from being interfered with one another. The top complex **122** and the bottom complex **126** are disposed with the upper internal conductive sheet **160** and the lower internal conductive sheet **170** respectively, and disposes the casing **110** to cover the above-mentioned components to provide the electrical connector **100** with better anti-electromagnetic interference effect. Besides, the assembly of the electrical connector **100** of the present invention begins with inserting the first terminals **130**, the external conductive sheet **150**, and the second terminals **140** into the top complex **122**, the center complex **124**, and the bottom complex **126** respectively via a production method such as Insert-Molding process, and thereafter performs a step of assembling the top complex **122**, the center complex **124**, and the bottom complex **126** together. Next, the conductive tail **156** and the partial portion of the second

terminals **140** that is positioned far away from the opening **112** of the casing **110** are covered with the block **180**, and finally the first positioning protrude **166** of the upper internal conductive sheet **160** and the second positioning protrude **172** of the lower internal conductive sheet **170** are inserted into the first engagement hole **124d** and the second engagement hole **124e** of the center complex **124** in such a manner that after the upper internal conductive sheet **160** and the lower internal conductive sheet **170** are disposed at a side of the top complex **122** and the center complex **124**, the upper internal conductive sheet **160** and the lower internal conductive sheet **170** together with the top complex **122** and the center complex **124** are inserted into the casing **110**. The configuration structure of the present invention and the above-mentioned assembly methods can effectively enhance the overall assembly yield.

While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.

What is claimed is:

1. An electrical connector, comprising:

- a casing;
- an insulative base disposed within said casing, including a top complex, a center complex, and a bottom complex in sequential connection;
- a plurality of first terminals configuring in said top complex;
- a plurality of second terminals configuring in said top complex;
- an external conductive sheet configuring in said center complex, isolating said plurality of first terminals and said plurality of second terminals;
- an upper internal conductive sheet fixed to said insulative base and disposed at a side of said top complex, sheltering a part of said plurality of first terminals; and
- a lower internal conductive sheet fixed to said insulative base and disposed at a side of said bottom complex sheltering a part of said plurality of second terminals, wherein said insulative base includes at least one first engagement hole and at least one second engagement hole, wherein said upper internal conductive sheet includes at least one first positioning protrude which is inserted into said first engagement hole; said lower internal conductive sheet includes at least one second positioning protrude which is inserted into said second engagement hole, wherein said first engagement hole and said second engagement hole are disposed within said center complex.

2. The electrical connector of claim 1, wherein said center complex includes a tongue, whose two opposite surfaces have a plurality of ditches for accommodating a part of said first terminals and a part of said plurality of second terminals.

3. The electrical connector of claim 1, wherein said internal conductive sheet includes a first section and a second section connected to said first section, wherein a turn is between said first section and said second section, and said first section covers a partial portion of the top complex, said second portion covers a part of said plurality of first terminals.

4. The electrical connector of claim 3, wherein said first section of the internal conductive sheet includes a plurality of arms, which slightly tilts toward said casing.

5. The electrical connector of claim 3, wherein said the second section of said internal conductive sheet includes a plurality of resistant contacts, which are used to contact a corresponding electrical connector to increase the insertion force between the two.

6. The electrical connector of claim 1, wherein said external conductive sheet includes an external conductive sheet body (hereafter, "ECS sheet") and a plurality of apertures penetrating said ECS body, wherein a part of said center complex extends into said apertures. 5

7. The electrical connector of claim 6, wherein said external conductive sheet includes at least one conductive tail perpendicular to said ECS body; at least one conductive tail and a part of said second terminals disposed at a position far away from an opening of said casing are arranged in the same 10 column.

8. The electrical connector of claim 1, wherein a part of said external conductive sheet is exposed to the leading edge and side edge of said center complex.

9. The electrical connector of claim 1, further includes a 15 block including a plurality of notches which are arranged in at least two rows, and the portion of said second terminals that are disposed at a position far away from the opening of said casing penetrates through at least one part of said notches.

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